

APPENDIX I

CONVERSION TABLES

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
Acres	43,560	square feet	Cubic inches	1.639×10^{-5}	cubic meters
Acres	4047	square meters	Cubic inches	2.143×10^{-5}	cubic yards
Acres	1.562×10^{-3}	square miles	Cubic inches	4.329×10^{-2}	gallons
Acres	5645.38	square yards	Cubic inches	1.639×10^{-2}	liters
Acres	4840	square yards	Cubic inches	0.03463	pints (liq)
Board-feet	0.2530	cubic inches	Cubic inches	0.01732	quarts (liq)
British thermal units	144 sq. in. \times 1 in.	kilogram-calories	Cubic meters	10^4	cubic centimeters
British thermal units	777.5	foot-pounds	Cubic meters	35.31	cubic feet
British thermal units	3.927×10^{-4}	horsepower-hours	Cubic meters	81.023	cubic inches
British thermal units	1054	joules	Cubic meters	1.303	cubic yards
British thermal units	107.5	kilogram-meters	Cubic meters	264.2	gallons
British thermal units	2.928×10^{-4}	kilowatt-hours	Cubic meters	10^3	liters
Btu per min	12.96	foot-pounds per sec	Cubic meters	2113	pints (liq)
Btu per min	0.2356	horsepower	Cubic meters	1057	quarts (liq)
Btu per min	0.01757	kilowatts	Cubic yards	7.646×10^5	cubic centimeters
Btu per min	17.57	watts	Cubic yards	27	cubic feet
Btu per sq ft per min	0.1220	watts per square inch	Cubic yards	46.656	cubic inches
Centiliters	0.01	liters	Cubic yards	0.7646	cubic meters
Centimeters	0.3937	inches	Cubic yards	202.0	gallons
Centimeters	0.01	meters	Cubic yards	764.6	liters
Centimeters	393.7	mils	Cubic yards	1616	pints (liq)
Centimeters	10	millimeters	Cubic yards	807.9	quarts (liq)
Cubic centimeters	3.531×10^{-3}	cubic feet	Cubic yards per minute	0.45	cubic feet per second
Cubic centimeters	6.102×10^{-2}	cubic inches	Cubic yards per minute	3.367	gallons per second
Cubic centimeters	10^{-6}	Cubic meters	Cubic yards per minute	12.74	liters per second
Cubic centimeters	1.306×10^{-6}	cubic yards	Cubic yards per minute		
Cubic centimeters	2.642×10^{-4}	gallons	Days	24	hours
Cubic centimeters	10^{-2}	liters	Days	1440	minutes
Cubic centimeters	2.113×10^{-3}	pints (liq)	Days	86,400	seconds
Cubic centimeters	1.057×10^{-3}	quarts (liq)	Fathoms	6	feet
Cubic feet	2.832×10^6	cubic cms	Feet	30.48	centimeters
Cubic feet	1728	cubic inches	Feet	12	inches
Cubic feet	0.02832	cubic meters	Feet	0.3048	meters
Cubic feet	0.03704	cubic yards	Feet	.36	yards
Cubic feet	7.481	gallons	Feet	1/3	yards
Cubic feet	28.32	liters	Feet of water	0.02950	atmosphere
Cubic feet	59.84	pints (liq)	Feet of water	0.8826	inches of mercury
Cubic feet	29.92	quarts (liq)	Feet of water	304.8	kgs per square meter
Cubic feet per minute	472.0	cubic cms per sec	Feet of water	62.43	pounds per sq ft
Cubic feet per minute	0.1247	gallons per sec	Feet of water	0.4335	pounds per sq inch
Cubic feet per minute	0.4720	liters per second	Foot-pounds	1.286×10^{-3}	British thermal units
Cubic feet per minute	82.4	lbs of water per min	Foot-pounds	1.356×10^7	ergs
Cubic feet per minute			Foot-pounds	5.050×10^{-7}	horsepower-hours
Cubic feet per minute			Foot-pounds	1.356	joules
Cubic inches	16.39	cubic centimeters	Foot-pounds	3.241×10^{-4}	kilogram-calories
Cubic inches	5.787×10^{-4}	cubic feet	Foot-pounds	0.1383	kilogram-meters

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
Foot-pounds	3.766×10^{-7}	kilowatt-hours	Kilometers	0.6214	miles
Gallons	3785	cubic centimeters	Kilometers	1093.6	yards
Gallons	0.1337	cubic feet	Kilowatts	56.92	Btu per min
Gallons	231	cubic inches	Kilowatts	4.425×10^2	foot-pounds per min
Gallons	3.785×10^{-3}	cubic meters	Kilowatts	737.6	foot-pounds per sec
Gallons	4.951×10^{-3}	cubic yards	Kilowatts	1.341	horsepower
Gallons	3.785	liters	Kilowatts	14.34	kg.-calories per min
Gallons	8	pints (liq)	Kilowatts	10^3	watts
Gallons	4	quarts (liq)	Liters	10^2	cubic centimeters
Horse-power	42.44	Btu per min	Liters	0.03531	cubic feet
Horse-power	33,000	foot-pounds per min	Liters	61.02	cubic inches
Horse-power	550	foot-pounds per sec	Liters	10^3	cubic meters
Horse-power	1.014	horsepower (metric)	Liters	1.308×10^{-2}	cubic yards
Horse-power	10.70	kg.-calories per min	Liters	0.2642	gallons
Horse-power	0.7457	kilowatts	Liters	2.113	pints (liq)
Horse-power	745.7	watts	Liters	1.057	quarts (liq)
Horse-power (boiler)	33.520	Btu per hour	Meters	100	centimeters
Horse-power (boiler)	9.804	kilowatts	Meters	3.2808	feet
Horse-power-hours	2547	British thermal units	Meters	39.37	inches
Horse-power-hours	1.98×10^4	foot-pounds	Meters	10^{-3}	kilometers
Horse-power-hours	2.684×10^4	joules	Meters	10^3	millimeters
Horse-power-hours	641.7	kilogram-calories	Meters	1.0936	yards
Horse-power-hours	2.737×10^4	kilogram-meters	Meter-kilograms	9.807×10^7	centimeter-dynes
Horse-power-hours	0.7457	kilowatt-hours	Miles	1.609×10^3	centimeters
Hours	60	minutes	Miles	5280	feet
Hours	3600	seconds	Miles	1.6093	kilometers
Inches	2.540	centimeters	Miles	1760	yards
Inches	10^4	mils	Miles	1900.8	yards
Inches	.03	yards	Ounces	8	drams
Inches of mercury	0.03342	atmospheres	Ounces	437.5	grains
Inches of mercury	1.133	feet of water	Ounces	28.35	grams
Inches of mercury	345.3	kgs per square meter	Ounces	0.0625	pounds
Inches of mercury	70.73	pounds per square ft	Ounces (fluid)	1.805	cubic inches
Inches of mercury	0.4912	pounds per square in	Ounces (fluid)	0.02957	liters
Inches of water	0.002458	atmospheres	Ounces (troy)	480	grains (troy)
Inches of water	0.07355	inches of mercury	Ounces (troy)	31.10	grams
Inches of water	25.40	kgs per square meter	Ounces (troy)	20	pennyweights troy
Inches of water	0.5781	ounces per square in	Ounces (troy)	0.08333	pounds (troy)
Inches of water	5.204	pounds per square ft	Ounces per sq inch	0.0625	pounds per sq inch
Inches of water	0.03613	pounds per square in	Pounds	7000	grains
Joules	9.486×10^{-4}	British thermal units	Pounds	453.6	grams
Kilograms	10^2	grams	Pounds	16	ounces
Kilograms	70.93	poundals	Pounds	32.17	poundals
Kilograms	2.2046	pounds	Pounds (troy)	0.8229	pounds (av)
Kilograms	1.102×10^{-2}	tons (short)	Pounds of water	0.01602	cubic feet
Kilometers	3281	feet	Pounds of water	27.68	cubic inches
Kilometers	10^3	meters	Pounds of water	0.1198	gallons

APPENDIX II

MATH FORMULAS

MATH FORMULAS

A. WEIGHTS AND MEASURES

Dry Measure

2 cups = 1 pint (pt)
2 pints = 1 quart (qt)
4 quarts = 1 gallon (gal)
8 quarts = 1 peck (pk)
4 pecks = 1 bushel (bu)

Liquid Measure

3 teaspoons (tsp) = 1 tablespoon (tbsp)
16 tablespoons = 1 cup
2 cups = 1 pint
16 fluid ounces (oz) = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
31.5 gallons = 1 barrel (bbl)
231 cubic inches = 1 gallon
7.48 gallons = 1 cubic foot (cu ft)

Weight

16 ounces = 1 pound (lb)
2,000 pounds = 1 short ton (T)
2,240 pounds = 1 long ton

Distance

12 inches = 1 foot (ft)
3 feet = 1 yard (yd)
5 1/2 yards = 1 rod (rd)
16 1/2 feet = 1 rod
1,760 yards = 1 statute mile (mi)
5,280 feet = 1 statute mile

Area

144 square inches = 1 square foot (sq ft)
9 square feet = 1 square yard (sq yd)
30 1/4 square yards = 1 square rod
160 square rods = 1 acre (A)
640 acres = 1 square mile (sq mi)

Volume

1,728 cubic inches = 1 cubic foot (cu ft)
27 cubic feet = 1 cubic yard (cu yd)

Counting Units

12 units = 1 dozen (doz)
12 dozens = 1 gross
144 units = 1 gross
24 sheets = 1 quire
480 sheets = 1 ream

Equivalents

1 cubic foot of water weighs 62.5 pounds (approx) = 1,000 ounces
1 gallon of water weighs 8 1/3 pounds (approx)
1 cubic foot = 7.48 gallons
1 inch = 2.54 centimeters
1 foot = 39.48 centimeters
1 meter = 39.37 inches
1 liter = 1.05668 quarts (liquid) = 0.90808 quart (dry)
1 nautical mile = 6,080 feet (approx)
1 fathom = 6 feet
1 shot of chain = 15 fathoms

B. MATHEMATICAL SYMBOLS

Symbol	Name or Meaning
+	Addition or positive value
−	Subtraction or negative value
±	Positive or negative value
·	Multiplication dot (Centered; not to be mistaken for decimal point.)
x	Multiplication symbol
()	Parentheses
[]	Brackets
{ }	Braces
—	Vinculum (overscore)
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> $\left. \begin{array}{l} () \\ [] \\ \{ \} \\ \text{—} \end{array} \right\}$ </div> <div>Grouping Symbols</div> </div>	
%	Percent
÷	Division symbol
:	Ratio symbol
::	Proportion symbol
=	Equality symbol
≠	“Not equal” symbol
<	Less than
≤	Less than or equal to
>	Greater than
≥	Greater than or equal to

Symbol	Name or Meaning
√	Square root symbol
√	Square root symbol with vinculum. Vinculum is made long enough to cover all factors of the number whose square root is to be taken.
π	Pi. The ratio of the circumference of any circle to its diameter. Approximate numerical value is 22/7 or 3.14

C. GEOMETRIC FORMULAS

(Area, Perimeter, Volume, Surface Area)

In the geometric formulas listed in this appendix, the following letter designations are used except as noted otherwise:

a, b, c, d, and e denote lengths of sides

h denotes perpendicular height

s denotes slant height

A denotes area (plane figures)

C denotes circumference

D denotes diameter

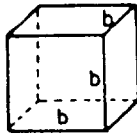
L denotes lateral area (lateral area)

P denotes perimeter

R denotes radius

S denotes surface area (solid figures)

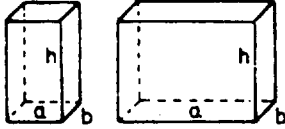
V denotes volume



CUBE

$$V = b^3$$

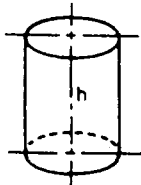
$$S = 6b^2$$



RIGHT RECTANGULAR PRISMS

$$V = abh$$

$$S = 2ab + 2ah + 2bh$$



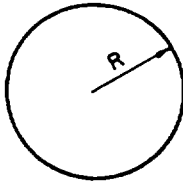
RIGHT CIRCULAR

$$V = \pi R^2 h$$

$$L = 2\pi R h$$

$$S = 2\pi R^2 + 2\pi R h$$

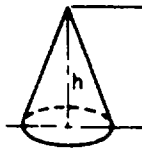
$$S = 2(\text{AREA OF BASE}) + (\text{CIRCUMFERENCE} \times \text{HEIGHT})$$



SPHERE

$$V = \frac{4\pi R^3}{3}, \quad V = 0.5236D^3 \text{ (APPROX.)}$$

$$S = 4\pi R^2, \quad S = \pi D^2$$

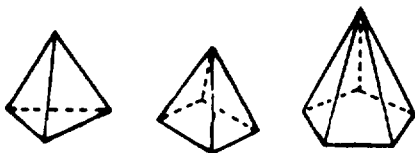


RIGHT CIRCULAR CONE

$$V = \frac{\pi R^2 h}{3}$$

$$L = s\pi R$$

$$S = s\pi R + \pi R^2 \text{ (TOTAL)}$$

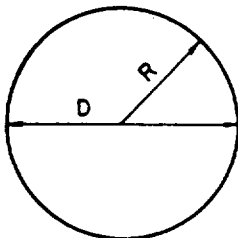


ANY REGULAR RIGHT PYRAMID

$$V = \frac{1}{3} \text{ HEIGHT} \times \text{AREA OF THE BASE}$$

$$L = \frac{1}{2} \text{ SLANT HEIGHT} \times \text{PERIMETER OF THE BASE}$$

NOTE: TO OBTAIN TOTAL SURFACE, ADD AREA OF BASE TO GIVEN SURFACE FORMULA.



CIRCLE

$$A = \pi R^2, \quad A = \frac{1}{4}\pi D^2$$

$$C = 2\pi R, \quad C = \pi D$$

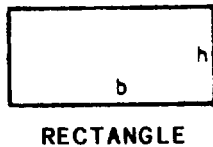


$$A = \frac{bh}{2}$$



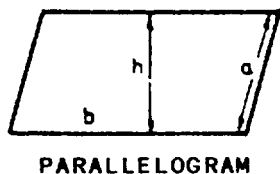
$$A = b^2$$

$$P = 4b$$



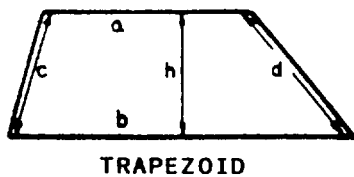
$$A = bh$$

$$P = 2b + 2h$$



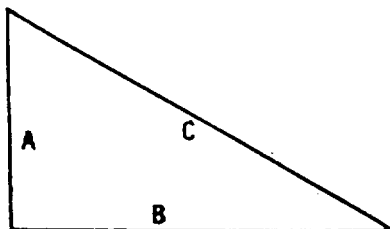
$$A = bh$$

$$P = 2a + 2b$$



$$A = \frac{h(a+b)}{2}$$

$$P = a + b + c + d$$



$$C(\text{HYPOTENUSE}) = \sqrt{A^2 + B^2}$$

1. BOARD FEET

$$\frac{\text{NO. OF PCS} \times \text{THICKNESS (IN.)} \times \text{WIDTH (IN.)} \times \text{LENGTH (FT.)}}{12}$$

2. CUBIC YARDS

$$\frac{\text{THICKNESS} \frac{\text{IN.}}{36} \left(\text{OR } \frac{\text{FT.}}{3} \right) \times \text{WIDTH} \frac{\text{IN.}}{36} \left(\text{OR } \frac{\text{FT.}}{3} \right) \times \text{LENGTH} \frac{\text{FT.}}{3}}$$

**INCHES REDUCED TO DECIMALS
(FOOT)**

INCHES	DECIMALS
1/2	0.041
1	0.083
1 1/2	0.125
2	0.167
2 1/2	0.209
3	0.250
3 1/2	0.292
4	0.333
4 1/2	0.375
5	0.417
5 1/2	0.458
6	0.500
6 1/2	0.542
7	0.583
7 1/2	0.625
8	0.667
8 1/2	0.708
9	0.750
9 1/2	0.792
10	0.833
10 1/2	0.875

INCHES DECIMAL

11	0.917
11 1/2	0.958
12	1.00

**COMMON FRACTIONS STATED
AS DECIMALS**

FRACTION	DECIMAL
1/16	0.0625
1/8	0.125
3/16	0.1875
1/4	0.250
5/16	0.3125
3/8	0.375
7/16	0.4375
1/2	0.500
9/16	0.5625
5/8	0.625
11/16	0.6875
3/4	0.750
13/16	0.8125
7/8	0.875
15/16	0.9375
16/16	1.00

APPENDIX III

REFERENCES

Chapter 1

Construction Mechanic 1, NAVEDTRA 10645-F1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1989.

Construction Mechanic 3 & 2, NAVEDTRA 10644-G1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1988.

Equipment Management, COMSECOND/COMTHIRDNCB 11200.1 Series, Department of the Navy, Naval Construction Battalions, U.S. Pacific Fleet, Pearl Harbor, Hawaii, Naval Construction Battalions, U.S. Atlantic Fleet, Naval Amphibious Base, Little Creek Norfolk, Va., 1988.

Equipment Management Manual, NAVFAC P-404, Naval Facilities Engineering Command, 200 Stovall Street, Alexandria, Va., 1988.

Equipment Operator 1, NAVEDTRA 10641-H1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1989.

Higgins, Lindley R., *Handbook of Construction Equipment Maintenance*, McGraw-Hill Book Company, New York N. Y., 1979.

Management of Transportation, NAVFAC P-300, Naval Facilities Engineering Command, 200 Stovall Street, Alexandria, Va., 1989.

Chapter 2

Embarkation Manual, COMSECOND/COMTHIRDNCBINST 3120.1 Series, Naval Construction Brigade, Pearl Harbor, Hawaii, Naval Amphibious Base, Little Creek, Norfolk Va., 1983.

Initial Outfitting Repair Parts and COSAL Support System, Civil Engineer Support Office (CESO), Construction Battalion Center, Port Hueneme, Calif.

MAC Affiliation Training Program, MAC Pamphlet 50-13, Department of the Air Force, Headquarters Military Airlift Command, Scott Air Force Base, Ill. 1987.

Naval Construction Force/Seabee Chief Petty Officer, NAVEDTRA 10600, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1989.

NMCB Operations Officer Handbook, COMSECOND/COMTHIRDNCBINST 5200.2A, Naval Construction Brigade, Pearl Harbor, Hawaii, Naval Amphibious Base, Little Creek Norfolk, Va., 1988.

Chapter 3

Cranes, Naval Ships' Technical Manual, S9086-T4-STM-010, Chapter 589, Commander, Naval Sea Systems Command, Washington, D. C., 1988.

Cranes and Attachments 1, SCBT 540.1, Naval Construction Training Center, Gulfport, Miss., 1988.

Cranes and Attachments 2, SCBT 540.2, Naval Construction Training Center, Gulfport, Miss., 1988.

Crane Handbook, Construction Safety Association of Ontario, Toronto, Ontario, Canada, 1982.

Crane & Rigging, Crane Technical Training & Inspection Inc., Altamonte Springs, Fla.

Equipment Operator 1, NAVEDTRA 10641-H1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1986.

Equipment Operator 3 & 2, NAVEDTRA 10640-J1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1984.

Management of Weight-Handling Equipment Maintenance and Certification, NAVFAC P-307, Naval Facilities Engineering Command, Alexandria, Va., 1989.

Mobile Crane Manual, Construction Safety Association of Ontario, Toronto, Ontario, Canada, 1982.

Rigging Manual, Construction Safety Association of Ontario, Toronto, Ontario, Canada, 1975.

Testing and Licensing of Weight-Handling and Construction Equipment Operators, NAVFAC P-306, Naval Facilities Engineering Command, Alexandria, Va., 1978.

Wire and Fiber Rope and Rigging, Naval Ships' Technical Manual, NAVSEA S9086-UU-STM-000/CH-613, Chapter 613, Commander, Naval Sea System Command, Washington, D.C., 1978.

Chapter 4

Earthwork Principles: Computing Volume, Programmed Instruction Division, U.S. Naval Schools Construction, Port Hueneme, Calif., 1971.

Equipment Operator 1 & C, NAVEDTRA 10641-G, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1979.

Equipment Operator 3 & 2, NAVEDTRA 10640-J1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1984.

Gradework Principles and Road Nomenclature, Programmed Instruction for Equipment Operator, Naval Construction Training Center, Gulfport, Miss.

Naval Construction Force Manual, NAVFAC P-315, Department of the Navy, Naval Facilities Engineering Command, Alexandria, Va., 1983.

Naval Construction Force/Seabee Chief Petty Officer, NAVEDTRA 10600, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1989.

Naval Construction Force/Seabee Chief Petty Officer First Class, NAVEDTRA 10601, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1989.

Naval Mobile Construction Battalion Crew Leaders Handbook, Naval Schools, Civil Engineer Corps Officers School, Port Hueneme, Calif., 1985.

Nichols, Herbert L., *Moving the Earth*, North Castle Books Inc., Greenwich, Conn., 1976.

NMCB Operations Officer Handbook, COMSECOND/COMTHIRDNCBINST 5200.2A, Naval Construction Brigade, Pearl Harbor, Hawaii, Naval Amphibious Base, Little Creek, Norfolk, Va., 1988.

Seabee Planner and Estimator Handbook, NAVFAC P-405, Department of the Navy, Naval Facilities Engineering Command, Alexandria, Va., 1985.

Chapter 5

Engineering Aid 3, NAVEDTRA 10696, Naval Education Training Program Management Support Activity, Pensacola, Fla., 1991.

Equipment Operator 1 & C, NAVEDTRA 10641-G1, Naval Education Training Program Management Support Activity, Pensacola, Fla., 1981.

NCF Welding Materials Handbook, NAVFAC P-433, Naval Facilities Engineering Command, Alexandria, Va., 1986.

Quarry Operations 1, U.S. Army Subcourse EN5463, U.S. Army Engineer School, Fort Belvoir, Va., 1989.

Steelworker 3 & 2, NAVEDTRA 10653, Naval Education Training Program Management Support Activity, Pensacola, Fla., 1980.

Chapter 6

Crusher HQ, Universal Engineer Corporation, Cedar Rapids, Iowa, 1982.

Equipment Operator 1 & C, NAVEDTRA 10641-G1, Naval Education Training Program Management Support Activity, Pensacola, Fla., 1981.

Management; Utilization of Engineering Construction Equipment, TM5-331, Department of the Army, Washington, D.C., 1962.

Nichols, Herbert L., *Moving the Earth*, 3rd ed., North Castle Books, INC, Greenwich, Connecticut, 1976.

Quarry Operations II, U.S. Army Subcourse EN5464, U.S. Army Engineer School, Fort Leonard Wood, Mo., 1989.

Chapter 7

Basics of Concrete, Concrete Construction Publication, Inc., Addison, Ill., 1986.

Builder 3 & 2, Volume 1, NAVEDTRA 10646, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1987.

Design and Control of Concrete Mixture, Portland Cement Association, Ill., 1988.

Engineering Aid 3, NAVEDTRA 10696, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1991.

CDC 55150 Pavements Maintenance Specialist, Volume 3, Flexible Pavements, Extension Course Institute, Gunter Air Force Base, Ala.

Trailer Mounted Mobile Concrete Mixer Plant, U.S. Navy Service Manual, Zimmerman Industries, Ephrata, Pa., 1987.

Chapter 8

Bituminous Pavements, U.S. Army Subcourse EN5459, U.S. Army Engineer School, Fort Belvoir, Va.

Engineering Aid 3 & 2, Volume 3, NAVEDTRA 10629-1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1984.

Equipment Operator 1, NAVEDTRA 10641-H1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1986.

Equipment Operator 1 & C, NAVEDTRA 10641-G1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1981.

Equipment Operator 3 & 2, NAVEDTRA 10640-J1, Naval Education and Training Program Management Support Activity, Pensacola, Fla., 1984.

Pavement Maintenance Specialist, Volume 3, Flexible Pavements Course 55150, U.S. Air Force Air University, Gunter Air Force Base, Montgomery, Ala.

Principles of Construction of Hot-Mix Asphalt Pavements, The Asphalt Institute Manual, Series No. 22, Asphalt Institute Building, College Park Md., 1983.

Chapter 9

Equipment Operator 1 & C, NAVEDTRA 10641-H, Naval Education Training Program Management Support Activity, Pensacola, Fla., 1986.

Geology, TM 5-545, Department of the Army, Washington, D.C., 1971.

Integrated Logistic Support Plan for the Lightweight Well Drilling Rig System, NAVFAC ILSP 0311, Department of the Navy, Naval Facilities Engineering Command, Alexandria, Va., 1985.

Self-Propelled Prototype Design Lightweight Easily Transported Well Drilling Rig, Ingersall-Rand Research, Inc., Princeton, N. J., 1985.

Water Well Drilling (Failing Rig), SCBT 530.1, Naval Construction Training Center, Gulfport, Miss., 1989.

Well Drilling Operations, TM 5-297/AFM 85-23, Departments of the Army and the Air Force, Washington D.C., 1965.

INDEX

A

- Air detachment, CESE and material preparation, 2-4, 2-6
- Air detachment, CESE requirements, 2-3
- Air detachment, crew assignments, 2-1
- Air detachment equipment supervisor responsibilities, 2-1
 - collateral equipage, 2-14
 - crew assignments, 2-1
 - equipment platoon administration readiness, 2-1 to 2-2
 - equipment platoon operations, 2-15 to 2-16
 - operator assignments, 2-3 to 2-4
 - site arrival, 2-14 to 2-15
 - site selection, 2-14
- Air detachment, mount-out/retrograde, 2-16 to 2-18
- Air detachment, palletized cargo, 2-11 to 2-14
- Air detachment, projects, 2-16
- Air detachment, table of allowance, 2-2 to 2-3
- Air detachment, vehicle shoring, 2-9 to 2-10
- Air detachment, weighing and marking, 2-4 to 2-9
- Apron feeder, 6-2
- Asphalt batch plant, 8-12 to 8-15
 - asphalt introduction, 8-14
 - discharge gate, 8-15
 - plant automation, 8-15
 - pugmill mixing, 8-14
- Asphalt, bituminous surfacing materials, 8-18
- Asphalt, compacted weight and volume, 8-32
- Asphalt, continuous-flow plant, 8-15 to 8-16
 - mixing time, 8-16
 - pugmill mixer, 8-15
- Asphalt, drum-mix plant, 8-16 to 8-18
 - aggregate storage and feed, 8-16 to 8-17
 - asphalt metering, 8-17
 - burner operation, 8-18
 - drum-mix operation, 8-17 to 8-18
 - surge silo, 8-18
- Asphalt, estimation of materials, 8-27
 - compute bituminous material, 8-31 to 8-33
 - estimates for asphalt plants, 8-33
 - prime coat, 8-27 to 8-28
 - surface treatment, 8-30 to 8-31
 - tack coat, 8-28 to 8-29
 - tons per hour, 8-33
- Asphalt, field identification of bituminous materials, 8-23 to 8-24
 - field penetration test, 8-26
 - heat-odor test, 8-26
 - pour test, 8-25
 - smear test, 8-26
 - solubility test, 8-24
 - stone-coating test, 8-26 to 8-27
- Asphalt plant operations, 8-2
 - aggregate cold-feed system, 8-2 to 8-5
 - asphalt heating and circulation, 8-10
 - dryer, 8-5 to 8-6
 - dust collector, 8-6 to 8-8
 - hot bin sampling, 8-9 to 8-10
 - hot bins, 8-9
 - hot screens, 8-8 to 8-9
 - mineral filler, 8-10 to 8-12
 - temperature of mixture, 8-10
- Asphalt plant safety, 8-34
- Asphalt plant supervisor responsibilities, 8-1 to 8-2
- Asphalt temperature ranges, 8-11

Asphalt, types and grades, 8-18

asphalt cements, 8-18 to 8-20

asphalt cutbacks, grades, and uses, 8-20 to 8-21

asphalt emulsions, uses, 8-21 to 8-22

tars, uses, 8-22 to 8-23

B

Battalion Equipment Evaluation Program (BEEP),
1-30 to 1-37

Blasting operations, 5-16

C

Compaction qualities of soil, 5-7 to 5-8

compactive effort, 5-8

material gradation, 5-7

moisture content, 5-7

Computations of asphalt materials, 8-27

bituminous materials, 8-31 to 8-33

prime coat, 8-27 to 8-28

surface treatment, 8-30 to 8-31

tack coat, 8-28 to 8-29

tons per hour, 8-33

Computations of concrete volume, 7-3 to 7-4

Computations of crane test weights, 3-13 to 3-16

Computations of earthwork, 4-4 to 4-11

Computations of equipment, 4-11

Concrete

batching, 7-4

computing volume of, 7-3 to 7-4

mixer cleaning, 7-5

mixing, 7-4

mobile mixer plant, 7-7

overmixing, 7-4 to 7-5

plant safety, 7-8

remixing, 7-5

slump test, 7-7 to 7-8

Concrete-Continued

transit mixer safety, 7-8

water, 7-3

Concrete additives, 7-3

air-entraining, 7-3

retarders, 7-3

Concrete aggregates, 7-2 to 7-3

handling and storage of aggregates, 7-2

Concrete batch plant supervisor responsibilities, 7-1

Construction Automotive Special Equipment/Management Information System (CASE/MIS),
1-3

equipment code (EC), 1-3

Tab A, 1-3

Conveyers, 6-10 to 6-11

incline, 6-11

loading, 6-11

speed, 6-11

Crane crew supervisor responsibilities, 3-1

crane, BEEP, 3-2, 3-7

crane crew, 3-1

crane license program, 3-2

qualifications, 3-1

Crane license program, 3-2

Crane operator's daily inspection, 3-7

hook block inspection, 3-9 to 3-10

sheave inspection, 3-10

wire rope end connections, 3-8 to 3-9

wire rope inspection, 3-7 to 3-8

Crane safety, 3-20

load capacity, 3-20 to 3-21

mishap reporting, 3-21

safe lifting, 3-21

stability, 3-20

training, 3-21

Crane, test procedures, 3-13

extension of certification, 3-20

frequency of test, 3-20

load test, 3-17 to 3-19

load test certification, 3-19 to 3-20

no-load test, 3-16 to 3-17

test weights, 3-13 to 3-16

Crusher primary unit, 6-1 to 6-4

Crusher supervisor responsibilities, 6-1

D

Dual roll crusher, 6-4 to 6-8

E

Earthwork computations, 4-4

cross sections, 4-7 to 4-11

road nomenclature, 4-7

slope ratio, 4-7

volume changes, 4-4 to 4-5

Equipment estimates, 4-11

Equipment maintenance, Equipment Repair Order (ERO), 1-25 to 1-29

Equipment maintenance levels, 1-23

depot maintenance, 1-23

intermediate maintenance, 1-23

organization maintenance, 1-23

Equipment maintenance live storage program, 1-25, 1-30

Equipment maintenance program, 1-18

maintenance inspector, 1-18

maintenance supervisor, 1-18

preventive maintenance (PM)/cost control clerk(s), 1-18 to 1-22

storage of petroleum products, 1-30

technical librarian, 1-23

Equipment maintenance, repair parts, 1-25

COSALS, 1-25

repair parts common, NAVSUPMOD 97, 1-25

repair parts peculiar, NAVSUPMOD 98, 1-25

Equipment maintenance scheduling, 1-23 to 1-25

type a (01) inspection, 1-23

type b (02) inspection, 1-23

type c (03) inspection, 1-23 to 1-25

Equipment management instructions, 1-1 to 1-2

Equipment Management Manual, NAVFAC P-404, 1-1

Management of Transportation Equipment, NAVFAC P-300, 1-1

Naval Construction Force Manual, NAVFAC P-315, 1-2

NMCB Equipment Management Instruction, COMSECOND/COMTHIRDNCB INST 11200.1, 1-2

H

Hydrocone crusher, 6-4 to 6-8

J

Jaw crusher, 6-1 to 6-4

L

License program, 1-35, 1-37

automotive test, 1-44

construction equipment operator license, NAVFAC 11260/2, 1-45 to 1-47

construction equipment test, 1-44

course of instruction, 1-48

license application forms, 1-38 to 1-43

license cancellation, 1-47

license examiner, 1-37

license files, 1-47

license forms, 1-44 to 1-45

license, lost or mutilated, 1-47

license renewal, 1-47

License program—Continued

- license suspension and revocation, 1-47
- license test, 1-44
- license upgrading, 1-47
- material-handling equipment test, 1-44
- mishap investigation, 1-48
- performance qualification test, 1-44
- personnel office, 1-47 to 1-48
- physical fitness inquiry form, 1-38, 1-44
- roadmaster, 1-48
- training license, 1-48
- training program, 1-48

M

Maintaining quarry equipment, 6-16

P

Pit operations, 5-11 to 5-13

Pit or quarry site preparation, 5-8 to 5-11

- chute loading ramps, 5-10
- clearing the site, 5-9
- drainage, 5-9
- operations plan, 5-9
- overburden, 5-9
- roads, 5-9

Pits and quarries, 5-1

- compaction qualities of soil, 5-7 to 5-8
- MOH's scale of hardness, 5-3
- pits, 5-1
- quarries, 5-1
- sieve analysis, 5-5 to 5-7
- site selection, 5-1
- soil formation, 5-1 to 5-3
- soil quality, 5-3 to 5-4
- types of quarry material, 5-4 to 5-5

Portland cement, 7-1 to 7-2

- storage of cement, 7-1
- types of cement, 7-1

Project supervisor responsibilities, 4-1

- concepts of construction, 4-2 to 4-3
- deployment planning, 4-3 to 4-4
- NMCB organization, 4-1
- prime contractor/lead company organization, 4-2
- project manager/resource manager organization, 4-2
- self-sufficient unit organization, 4-3

Q

Quarry equipment, 5-15

- maintenance, 5-16
- wearfacing, 5-15 to 5-17

Quarry operations, 5-13

- quarry development, 5-13 to 5-15
- quarry terminology, 5-13

Quarry supervisor responsibilities, 5-1

R

Rock crusher, 6-1

- blocking, 6-3
- bridging, 6-3
- choking, 6-3
- closed circuit crushing system, 6-8
- dual roll crusher, 6-4 to 6-8
- heavy-duty apron type of feeder, 6-2
- hydrocone crusher, 6-4 to 6-8
- packing, 6-3
- primary unit, 6-1 to 6-4
- secondary unit, 6-4 to 6-8

Rock crusher plant layout, 6-13 to 6-15

- plant erection, 6-15 to 6-16

Rock crusher, screens, 6-8 to 6-9

capacity, 6-9

feeding material to screen, 6-9

screen selection, 6-9 to 6-10

variable factors, 6-9

Rock crusher, secondary unit, 6-4 to 6-8

Rock crusher, wash plant, 6-11 to 6-12

Rotary well drilling, 9-4 to 9-9

kelly-drive drilling, 9-9 to 9-10

top-head drive drilling, 9-10 to 9-13

S

Safety

asphalt plant, 8-34

concrete plant, 7-8

concrete transit mixer, 7-8

cranes, 3-20 to 3-21

well drilling, 9-16 to 9-17

wire rope, 3-23 to 3-26, 3-32 to 3-33

Sieve analysis, 5-5 to 5-7

Slings, wire rope sling and rigging hardware, 3-21 to 3-22

bridle hitch, 3-23

eye splice, 3-26 to 3-28

single-vertical hitch, 3-22 to 3-23

sling, 3-22

sling angle, 3-23

sling inspection, 3-30 to 3-32

sling, proof testing, 3-28 to 3-30

sling and rigging gear kits, 3-30

sling, records, 3-30

sling, safe working loads, 3-23 to 3-26

sling, storage, 3-30

sling, wire rope lubrication, 3-32

sling, wire rope maintenance, 3-32

sling, wire rope safe operating procedures, 3-32 to 3-33

Supervisor responsibilities

asphalt plant, 8-1 to 8-2

concrete batch plant, 7-1

crusher, 6-1

projects, 4-1

quarry, 5-1

transportation, 1-1

well drilling, 9-1

T

Transportation supervisor responsibilities, 1-1

attachment custodian, 1-16

bus service, 1-18

category of assignments, 1-9 to 1-10

CESE assignments, 1-9

Collateral Custodian Record Card, COM-SECOND/COMTHIRDNCB 60 form, 1-14

collateral equipage, 1-13

collateral equipage custodian, 1-13 to 1-16

component collateral equipage, 1-13

dispatcher, 1-3

dispatcher logs, 1-4 to 1-8

equipment availability, 1-13

equipment cycling, 1-12

equipment request, 1-9, 1-11 to 1-12

equipment status board, 1-3 to 1-4

fuel operations, 1-16 to 1-17

maintenance field crew operations, 1-18

PM-to-interim repair ratio, 1-12 to 1-13

preventive maintenance, 1-12

tactical collateral equipage, 1-13

tool kit, 1-12

tractor-trailer operations, 1-17

trouble reports file (hard-card file), 1-9

washing of CESE, 1-12

yard boss, 1-12

W

Well development and completion, 9-15 to 9-16

Well drilling difficulties, 9-13 to 9-14

crooked holes, 9-14

fishing, 9-15

recovery of stuck drill pipe, 9-14 to 9-15

Well drilling safety, 9-16 to 9-17

Well drilling supervisor responsibilities, 9-1

groundwater exploration, 9-3 to 9-4

kelly-drive rotary drilling operations, 9-9 to 9-10

mud pits, 9-9

rotary drilling, 9-4 to 9-6

rotary drilling bits, 9-9

rotary drilling crew, 9-6 to 9-9

top-head drive rotary well drilling, 9-10 to 9-13

types of wells, 9-4

water sources, 9-1 to 9-3